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Results of the 1986-1988 Inshore Rockfish Harvest Log Program

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ABSTRACT

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In 1986, a rockfish harvest log program was initiated to satisfy the need for more precise information on the inshore commercial rockfish fishery. This report summarizes the results for the first three years of the program. The percentage of handline/troll vessels that submitted both harvest logs and sales slips increased from 27% in 1986 to 36% in 1988 and the percentage for longline vessels increased from 21% to 34%. A larger catch was reported on sales slips than on harvest logs for most areas; however, the discrepancy between the two data sources decreased over time. In 1988, harvest logs recorded at least 234 t of rockfish that were unreported on sales slips. Harvest logs also indicated that substantial amounts of yelloweye rockfish (Sebastes ruberrimus) are caught incidentally to the halibut and dogfish fisheries. Harvest log and sales slip catch per unit effort (CPUE) followed similar trends between 1986-88 for areas where landings were high.

RÉSUMÉ

Hand, C. M., J. R. Candy, and L. J. Richards. 1990. Results of the 1986-1988 inshore rockfish harvest log program. Can. MS Rep. Fish. Aquat. Sci. 2069: 41 p.

En 1986, un programme de vérification des livres de pêche du sébaste a été amorcé pour répondre au besoin d'information plus précise sur les pêches côtières de sébaste commercial. Le présent rapport résume les résultats des trois premières années d'application du programme. Le pourcentage des bateaux de pêche à lignes à main/lignes traînantes qui a présenté ses livres de pêche et ses reçus de caisse a augmenté, passant de 27 p. 100 en 1986 à 36 p. 100 en 1988, et le poucentage des bateaux à palangre à avoir présenté livres de pêche et reçus de caisse a augmenté de 21 à 34 p. 100. Les reçus de caisse indiquaient des prises plus volumineuses que les livres de pêche pour la plupart des régions; cependant, le décalage entre les deux sources de données s'est amenuisé avec le temps. En 1988, les livres de pêche indiquaient au moins 234 tonnes de sébaste qui ne figuraient pas sur les reçus de caisse. Ils révélaient également un volume considérable de prises accessoires de sébaste aux yeux jaunes (Sebastes ruberrimus), à l'occasion de la pêche du flétan et de l'aiguillat noir. On a observé des tendances analogues entre 1986 et 1988 dans le volume des prises indiqué dans les livres de pêche et sur les reçus de caisse par unite d'effort (PPUE), dans les régions où le volume des débarquements était important.

INTRODUCTION

Handline/troll and longline rockfish landings in the Strait of Georgia averaged about 65 t/yr between 1954 (the first year for which catch data became available) and 1976. Since 1976, landings have increased, reaching a high of 480 t in 1988 (Richards and Hand 1990). On the west coast of Vancouver Island and the north coast of British Columbia, rockfish landings remained low until 1985, when they began to increase rapidly. Over 1,000 t were landed in 1988. The increase in landings can largely be accounted for by the high prices paid for live rockfish (primarily quillback rockfish, Sebastes maliger, and copper rockfish, S. caurinus) and by a developing longline fishery for yelloweye rockfish.

Inshore rockfish stock assessments have been conducted annually since 1986. These assessments rely primarily on catch and effort data obtained from the sales slip database. This database is compiled and maintained by the Department of Fisheries and Oceans, Fisheries Branch. It contains sales slip information on: statistical area fished (Fig. 1), number of days fished, gear used, and the total weight of catch by market category. It does not contain a breakdown of the rockfish catch by species, nor does it detail specific locality or specific fishing techniques. Such additional information may be important in interpreting catch and catch per unit effort (CPUE) trends for stock assessment purposes.

Inshore rockfish fishing by handline/troll or longline is scheduled under a Z licence. The change in licensing from 'C' to 'Z-N' was implemented in 1986, in response to increasing interest in the fishery. In addition to the change in licensing, submission of harvest logs became mandatory. Each Z-N licence-holder is now required, as a condition of their licence, to submit harvest logs detailing: catch by species, fishing effort, fishing location, depth fished, and fishing gear. Hand and Richards (1988) document the results of the first year of the harvest log program (1986). This report presents an analysis of harvest log data from 1986 to 1988. The analysis includes comparisons of harvest logs and sales slips for each year on the basis of catch by geographical area, species composition, and trends in CPUE. In 1989, the harvest log program was transferred to Offshore Division, Fisheries Branch.

METHODS

Ease of data entry was a major criterion in the design of harvest logs (Fig. 2). The top two lines of the log identify the skipper, fishing vessel, CFV number and fishing method. The remainder of the log is a series of columns used to record date fished, statistical area, location of fishing, depth fished, hours fished, number of hooks used, the number of fish kept, and additional remarks. Labelled columns provide space for recording the most common species in the inshore fishery, including quillback rockfish, copper rockfish, yelloweye rockfish and lingcod (Ophiodon elongatus). An additional column is used to identify the number of other species caught. Fishermen complete one line of the log for each day fished.

Department of Fisheries and Oceans personnel transfer the log information to coding forms, with each day fished coded as a separate record. These data are, in turn, transferred to files maintained on a Microvax 3500 computer at the Pacific Biological Station. An attempt is made to code all details provided by fishermen, e.g., whether or not the fish were caught incidentally to other species.

Fishermen frequently submit incomplete harvest logs and a series of error codes are used to describe the missing information. One code flags records that are missing minor details such as depth and/or statistical area fished. A second code identifies records that cannot be used to determine a vessel's total catch. This would include logs for which catch units (number or weight) are unclear or for which catch is aggregated over all species. Records that do not include the date or hours fished, that sum fishing effort over a number of days, or that roughly estimate effort cannot be used for subsequent CPUE analysis and are flagged with a third code.

As a first step in the analysis, the number of fish caught is converted to catch in weight (kg). Conversion rates are based on the mean weight of biological samples from the commercial fishery and are derived from several sources. The mean weight of rockfish has not changed between 1984 and 1989 in any of the areas from which commercial samples were obtained, except for statistical area 13 (Richards and Hand 1990). The quillback rockfish samples that demonstrated the decline in mean size, in 1986 and 1987, were obtained from Discovery Passage, a sub-area within statistical area 13 which was heavily fished in the early part of the live fishery. Since the amount of rockfish taken from this sub-area, relative to the whole of area 13, is unknown, the standard conversion rate for quillback rockfish was applied to all areas. The conversion rates (kg) by species and statistical area are as follows:

Species	Area	Weight (kg)	Source
Quillback Rockfish	1-29	0.78	Cass et al. 1986
Copper Rockfish	1-29	0.62	Cass et al. 1986
Yelloweye Rockfish	1-10	4.2	PBS data files
Yelloweye Rockfish	12-19	2.2	PBS data files
Yelloweye Rockfish	20-27	3.5	PBS data files
Unknown Rockfish	1-29	0.78	Cass et al. 1986
Lingcod	1-29	3.1	Hand and Richards 1987

Two measures of CPUE were calculated from the harvest log and sales slip databases: (1) quillback and copper rockfish (hereafter referred to as 'rockfish') caught with handline/troll gear and (2) yelloweye rockfish (hereafter referred to as 'yelloweye') caught with longline gear. Much of the rockfish and yelloweye catch is landed incidentally to other species. In order to exclude incidental catches from CPUE calculations, the data are qualified by considering only records with landings of at least 20 kg/d of rockfish or 25 kg/d of yelloweye. Elimination of records that failed to satisfy these criteria resulted in higher values of mean CPUE and lower variances than would be obtained by including all records (Hand and Richards 1988). Sales slip data are similarly qualified by employing a minimum criterion of 50 kg of total rockfish reported per record (Richards and Hand 1990). This is comparable to the harvest log criterion because sales slip records usually represent catches from several days of fishing. To compare sales slip and harvest log CPUE, harvest log CPUE is calculated in units of kg/d, where a fishing day is defined as one record.

RESULTS

VESSEL COMPLIANCE/FLEET DYNAMICS

The number of vessels holding a Z-N licence increased from 1,101 to 1,618 between 1986 and 1987 and then declined to 1,516 in 1988. Many of the licensed vessels target other species and only land rockfish incidentally. To eliminate non-directed landings from the sales slip data for this analysis, vessels that landed less than 20 kg of rockfish/yr were excluded. The number of vessels excluded by this process accounted for 65% of the handline/troll vessels and 15% of the longline vessels.

The number of vessels reporting handline/troll landings (≥20 kg) on either sales slips or harvest logs increased between 1986 and 1987 and then declined in 1988 (N, Fig. 3). The percentage that submitted both harvest logs and sales slips increased from 27% in 1986 to 36% in 1987 and 1988. The percentage of the remainder that submitted sales slips but not logs decreased while those that submitted logs but not sales slips increased (Fig. 3).

The number of vessels reporting longline landings (≥20 kg) on either sales slips or harvest logs increased from 1986 to 1988 (N, Fig. 3). The percentage that submitted both harvest logs and sales slips increased from 21% in 1986 to 34% in 1988. The percentage of vessels that submitted harvest logs, but not sales slips, increased each year of the study.

The increase in the reporting rate for harvest logs probably results from increased awareness of the harvest log program. At the same time, sales slip coverage is decreasing. This could occur, for instance, if fish were sold at dockside or were used as bait. The harvest logs provide a method for recording these landings.

ROCKFISH CATCH

There is considerable variability in landings among areas for both sales slips and harvest logs. Furthermore, the two data sources agree poorly in the total landings by statistical area. Statistical areas are therefore grouped by geographical region to provide a more meaningful comparison of landings between harvest logs and sales slips. The selected geographical regions are: north coast (statistical areas 1-5), central coast (areas 6-10), west coast Vancouver Island (areas 11, 20-27), Port Hardy (area 12), Campbell River (area 13), Sechelt (areas 15 and 16), and Gulf Islands (areas 14, 17-19). Harvest log landings by handline/troll and longline for 1986 to 1988 are shown in Table 1.

In general, sales slips capture more of the rockfish landings than do harvest logs for both handline/troll gear and longline gear (Fig. 4a & b). Sales slip handline/troll landings from the west coast of Vancouver Island and the Port Hardy area have been consistently higher than their harvest log counterparts. In most other regions of the coast, however, the two data sources agree reasonably well. This is particularly true for the Campbell River area and the Gulf Islands. The discrepancy in total landings between the two data sources decreased between 1986 and 1988. This is probably due to a combination of improved reporting rates on harvest logs and poorer reporting rates on sales slips, as discussed in the

previous section. Higher landings by longline gear are reported from the west coast of Vancouver Island and from the north coast of B.C. on sales slips than on the harvest logs; longline landings from other areas of the coast show fairly close agreement between the two sources.

Much of the quillback, copper and yelloweye rockfish caught in British Columbia is landed incidentally to fisheries on other species. In 1988, 31% of the yelloweye rockfish caught by longline on the west coast of Vancouver Island was reported as incidental during dogfish and halibut fisheries. On the north coast, the halibut longline fishery landed 17% of the total yelloweye reported on harvest logs, while 52% of the yelloweye caught in the Campbell River area was reported incidental to the dogfish fishery. Minor amounts of quillback and copper rockfish are taken incidentally to halibut and dogfish by longline and to salmon by troll gear. These estimates of incidental catch are conservative, because harvest logs rarely list 'target species'. It is also likely that the submission rate of harvest logs is poorer for an incidental catch and that large amounts are dumped on the grounds.

Certain rockfish landings that are recorded on harvest logs often do not appear on sales slips. If harvest logs and sales slips are compared on the basis of landings from individual vessels, the amount of rockfish reported uniquely on harvest logs is 145 t from longline gear (24% of the rockfish catch reported on harvest logs) and 89 t from handline gear (21%). This unreported catch increases the 1988 coastwide total rockfish catch to 1730 t. The unreported rockfish catch identified by harvest logs is a conservative estimate. Only landings from vessels with no corresponding sales slip records were included.

SPECIES COMPOSITION

Quillback, copper and yelloweye rockfish and lingcod were the most important species in the catch. Species caught in minor amounts include tiger rockfish (Sebastes nigrocinctus), black rockfish (S. melanops), yellowtail rockfish (S. flavidus), bocaccio (S. paucispinis), china rockfish (S. nebulosus), and canary rockfish (S. pinniger). The 1988 coastwide catch of these species is estimated from harvest logs to be 97 t.

Quillback and copper rockfish dominated the handline/troll catch in areas inside Vancouver Island (Fig. 5). The proportions of quillback and copper rockfish in the catch within the Strait varied among regions; the Port Hardy catch was dominated by quillback while the catch from other areas contained relatively more copper rockfish. The proportion of yelloweye rockfish in the Gulf Islands and Sechelt catch decreased between

rockfish in the Gulf Islands and Sechelt catch decreased between 1986 and 1988 with a concomitant increase in the quillback/copper proportion. Lingcod and yelloweye rockfish were the primary constituents of the handline/troll catch from the west coast of Vancouver Island; the relative proportions of these species in the catch were similar between 1986 and 1988. Yelloweye rockfish and lingcod dominated the north coast handline/troll catch, with these species accounting for increasing proportions of the total catch between 1986 and 1988. Yelloweye rockfish and lingcod dominated the central coast species composition in 1986 and 1987. In 1988, the quillback component increased as a result of the expansion of the handline/troll fishery near Bella Bella (area 7). In general, copper rockfish is a negligible component of the north, central and west coast catches.

Yelloweye rockfish dominated the longline catch in most regions. The exceptions were the Gulf Islands and in 1988, the central coast, where quillback rockfish were taken in substantial amounts. In both cases, the landings were all reported by a single longline vessel targeting on quillback. Lingcod account for approximately 15% to 30% of the reported longline catch on the west coast of Vancouver Island and on the north and central coasts.

CATCH PER UNIT EFFORT

For both sales slip and harvest log data, the distributions of CPUE for rockfish caught by handline/troll gear and yelloweye caught by longline gear were highly skewed. Power transformations have been used to normalize CPUE data in other contexts (Quinn 1985, Richards 1987). A 0.3 power-transformation ($X^{0.3}$) applied to harvest log handline/troll CPUE resulted in a distribution that was approximately normal. A logarithmic transform was adequate for harvest log longline CPUE and sales slip CPUE.

Mean CPUE was calculated in kg/h and kg/d for both quillback/copper rockfish caught by handline/troll gear and for yelloweye rockfish taken by longline gear. Because there were large differences in CPUE among statistical areas, areas were combined into geographical regions to compare sales slip and harvest log CPUE. For handline/troll data, the groupings were identical to those used to compare landings. Different groupings, related to the distribution of the fishery, were used to compare longline CPUE for yelloweye. These were defined as follows: Queen Charlotte Islands (areas 1 and 2), north coast (areas 3-5), central coast (areas 6-10), west coast Vancouver Island (areas 11, 20-27), and east coast Vancouver Island (areas 12-19).

Table 2 summarizes rockfish handline/troll catch, total effort, and CPUE (kg/hr) by statistical area. CPUE remained relatively constant or increased slightly in the areas with most of the fishing effort. The increase in CPUE is characteristic of a developing fishery.

Harvest log and sales slip CPUE values are not directly comparable because the data are standardized by different methods. There is no independent method to determine which value is more representative. Further, there are no clear trends in CPUE for either harvest logs or sales slips. Within geographical regions with high landings, such as Port Hardy and Campbell River, trends in CPUE are similar for the two data sources (Fig. 7). Where CPUE is based on fewer landings, as in the north coast, central coast and Sechelt, the trends in CPUE for the two data sources are dissimilar. The 95% confidence intervals about the mean CPUE for these areas is large, compared to the areas where landings were high (Table 3). On the central coast in 1988, harvest log CPUE increased dramatically. This probably results from a large increase in directed effort by the handline fleet, following the 1987 winter closure on the south coast. This increase in CPUE was not evident in the sales slips, although the landings reported on sales slips did increase.

Discrepancies in yelloweye CPUE (Fig. 8) between sales slips and harvest logs can be explained largely by differences in reporting rates. The yelloweye fisheries in the Queen Charlotte Islands and on the north coast are relatively new. The high values of harvest log CPUE from these two areas in 1986 are due to the lower efforts reported, relative to the sales slip data. Values of CPUE from the first year of the program are therefore not representative of the fishery.

Harvest logs provide a more precise estimate of CPUE than do sales slips (Table 3). It is not clear whether this difference is meaningful, however, because confidence intervals are affected by sample size and these are measured differently for each data source. The sales slips record cumulative landings over several days, whereas harvest logs record landings for each day fished. The expected number of records for a given area is therefore greater for harvest logs than for sales slips.

The harvest log program provides detailed information on the inshore rockfish fishery. However, the benefits derived may not be worth the extra cost on an ongoing basis. Approximately one half of a person-year is required to process the harvest log data. With manpower limitations, the complete data base for a given year is available no sooner than the sales slip data base. The harvest logs include fewer rockfish landings than sales slips, although some landings were recorded uniquely on harvest logs. Information on species composition is important in interpreting abundance trends, but many fishermen are unable to correctly identify rockfish to the species level. Further,

trends in CPUE appear similar for harvest log and sales slip data for areas where the fishery is concentrated, although harvest logs may be more sensitive to changes in the fishery than sales slips.

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LITERATURE CITED

Cass, A. J., L. J. Richards and J. R. Selsby. 1986. A summary of rockfish samples collected from the commercial handline fishery in Statistical Area 13 between July 1984 and March 1985. Can. MS Rep. Fish. Aquat. Sci. 1881: 49 p.

Hand, C. M. and L. J. Richards. 1987. Hook and line survey of lingcod (Ophiodon elongatus) and rockfish (Sebastes spp.) stocks in the Gulf Islands region (MSA 17) of the Strait of Georgia, January and February, 1987. Can. MS Rep. Fish. Aquat. Sci. 1957: 57 p.

Hand, C. M. and L. J. Richards. 1988. Results of the 1986 rockfish harvest log program. Can. MS Rep. Fish. Aquat. Sci. 1986: 23 p.

Quinn, T. J. 1985. Catch-per-unit-effort: a statistical model for Pacific halibut (Hippoglossus stenolepsis). Can. J. Fish. Aquat. Sci. 42: 1423-1429.

Richards, L. J. 1987. Comparing imprecise abundance indices with a symmetric model. Can. J. Fish. Aquat. Sci. 44: 793-802.

Richards, L. J. and C. M. Hand. 1990. Inshore Rockfish. In: A. V. Tyler and J. Fargo [eds.]. Groundfish stock assessments for the west coast of Canada in 1989 and recommended yield options for 1990. Can. Tech. Rep. Fish. Aquat. Sci. in press.

Table 1. Landings (kg) of quillback, copper and unknown rockfish ('ROCK'), yelloweye rockfish ('YE') and lingcod ('LC') by geographical area and year, from harvest logs. Statistical areas corresponding to the geographical groupings are given in parentheses.

a) Handline/troll

	1986			1987			1988		
Geographical Area	ROCK	YE	LC	ROCK	YE	LC	ROCK	YE	LC
North Coast (1-5)	4265	15451	11088	7241	36922	32970	4155	30522	33554
Central Coast (6-10)	3623	13136	12319	8453	26874	23316	40539	21917	23278
West Coast (11, 20-27)	11755	33451	60330	25499	54013	122870	14048	27501	85023
Port Hardy (12)	49876	7509	6931	45670	5283	6809	112460	13056	19505
Campbell R. (13)	131248	9191	29171	102430	5904	21486	61306	5884	12106
Sechelt (15, 16)	3800	3774	484	4324	3765	465	3968	1519	551
Gulf Is. (14, 17-19)	48673	7884	4177	60796	5687	9246	61240	3273	6675

b) Longline

	1986			1987			1988		
Geographical Area	ROCK	YE	LC	ROCK	YE	LC	ROCK	YE	LC
North Coast (1-5)	1812	20315	5910	14494	118437	53509	9738	166256	39294
Central Coast (6-10)	1234	18616	5528	4234	77936	27724	32291	57635	18458
West Coast (11, 20-27)	10771	138533	53610	17899	269715	84307	32537	166940	49510
Port Hardy (12)	4314	1942	921	4392	12562	843	3066	39021	1192
Campbell R. (13)	465	5776	33	857	3095	296	266	8765	33
Sechelt (15, 16)	3723	47096	102	2361	42261	275	2139	32868	280
Gulf Is. (14, 17-19)	28446	20166	2965	10192	30174	1281	16462	15345	1662

Table 2. Rockfish[1] handline catch (kg) from harvest logs, effort (hrs) and rockfish CPUE (kg/hr) for 1986, 1987 and 1988. Effort was calculated from the ratio of rockfish catch to CPUE.

	1986			1987			1988		
Area	Catch	Effort	CPUE	Catch	Effort	CPUE	Catch	Effort	CPUE
1	12	7	1.71	1455	1022	1.42	1477	830	1.78
2	711	648	1.10	874	191	4.58	549	523	1.05
4	2040	411	4.97	2753	389	7.08	817	680	1.20
5	1191	258	4.61	2154	652	3.31	2522	573	4.40
6	498	357	1.39	3679	2001	1.84	4481	853	5.26
7	575	116	4.94	958	354	2.70	31325	2458	12.74
8	1858	213	8.72	1968	300	6.57	1625	462	3.52
9	513	176	2.91	195	50	3.89	3064	321	9.54
10	179	46	3.90	1653	1264	1.31	443	262	1.69
11	1857	569	3.26	10672	1676	6.37	2907	948	3.07
12	49876	7388	6.75	45670	5871	7.78	114087	14593	7.82
13	131248	17304	7.58	102430	12733	8.04	75181	9106	8.26
14	368	33	11.21	1497	332	4.51	388	546	0.71
15	974	138	7.06	300	41	7.42	818	145	5.65
16	2826	835	3.38	4024	1248	3.22	3150	440	7.16
17	12223	2185	5.59	17633	2721	6.48	23124	3623	6.38
18	27275	3468	7.86	25756	3305	7.79	21535	2489	8.65
19	8807	1299	6.78	15910	1676	9.49	20446	2576	7.94
20	4563	235	19.43	1163	614	1.89	2071	790	2.62
21	662	43	15.53	502	114	4.42	67	115	0.58
23	2111	294	7.19	664	280	2.37	609	357	1.71
24	963	312	3.09	3699	2201	1.68	4136	1333	3.10
25	437	254	1.72	3080	1270	2.42	776	676	1.15
26	288	591	0.49	224	408	0.55	3119	950	3.28
27	862	370	2.33	5483	2789	1.97	1229	1050	1.17

[1]Excluding yelloweye rockfish.

Table 3. Lower (L) and upper (U) limits of the 95% confidence intervals for mean CPUE (kg/d) from harvest logs and sales slips, by geographical area, 1986-1988.

A. Rockfish by handline/troll gear

	Harvest logs						Sales slips					
	1986		1987		1988		1986		1987		1988	
Geographical Area	L	U	L	U	L	U	L	U	L	U	L	U
North Coast (1-5)	19.4	29.6	23.6	31.3	15.0	22.3	28.1	53.4	18.9	40.5	15.5	31.6
Central Coast (6-10)	17.4	26.6	17.6	27.3	59.7	70.8	25.7	51.1	32.8	59.3	39.1	58.2
W Coast Van Is.(11,20-27)	17.9	27.0	18.3	21.8	14.6	18.9	34.6	48.6	33.0	42.5	34.4	48.1
Port Hardy (12)	48.0	53.1	42.1	45.6	47.9	50.4	50.0	62.2	42.7	51.7	43.6	50.4
Campbell R. (13)	45.0	47.4	46.7	48.7	52.6	56.9	34.6	37.9	37.1	42.1	43.0	49.3
Gulf Is. (14,17-19)	44.8	48.7	46.0	49.4	43.6	47.0	56.7	69.3	46.8	54.8	40.5	48.4
Sechelt (15,16)	16.4	25.0	17.2	22.2	34.9	43.9	21.3	44.1	17.7	32.8	14.5	24.5

B. Yelloweye Rockfish by longline gear

	Harvest Logs						Sales Slips					
	1986		1987		1988		1986		1987		1988	
Geographical Area	L	U	L	U	L	U	L	U	L	U	L	U
Queen Charlottte Is (1,2)	423.4	641.2	181.9	243.0	207.0	271.8	30.0	164.1	38.8	117.4	81.1	211.3
North Coast (3-5)	234.8	397.2	113.0	209.3	133.6	238.9	28.4	102.6	63.1	113.8	36.7	122.9
Central Coast (6-10)	120.3	188.5	137.6	180.6	157.5	199.3	17.0	117.2	36.2	130.9	51.6	229.1
W Coast Van Is.(11,20-27)	210.5	269.8	162.6	192.9	162.8	195.5	96.6	155.1	91.7	141.7	109.6	165.8
E Coast Van Is. (12-19)	83.7	92.3	85.3	95.9	90.0	101.3	33.5	60.8	45.0	68.6	30.6	56.0

Fig. 1a. Statistical areas along the British Columbia south coast.

Fig. 1a. **STATISTICAL AREA MAP**

SHOWING AREAS OF CATCH FOR
BRITISH COLUMBIA WATERS
SOUTHERN HALF

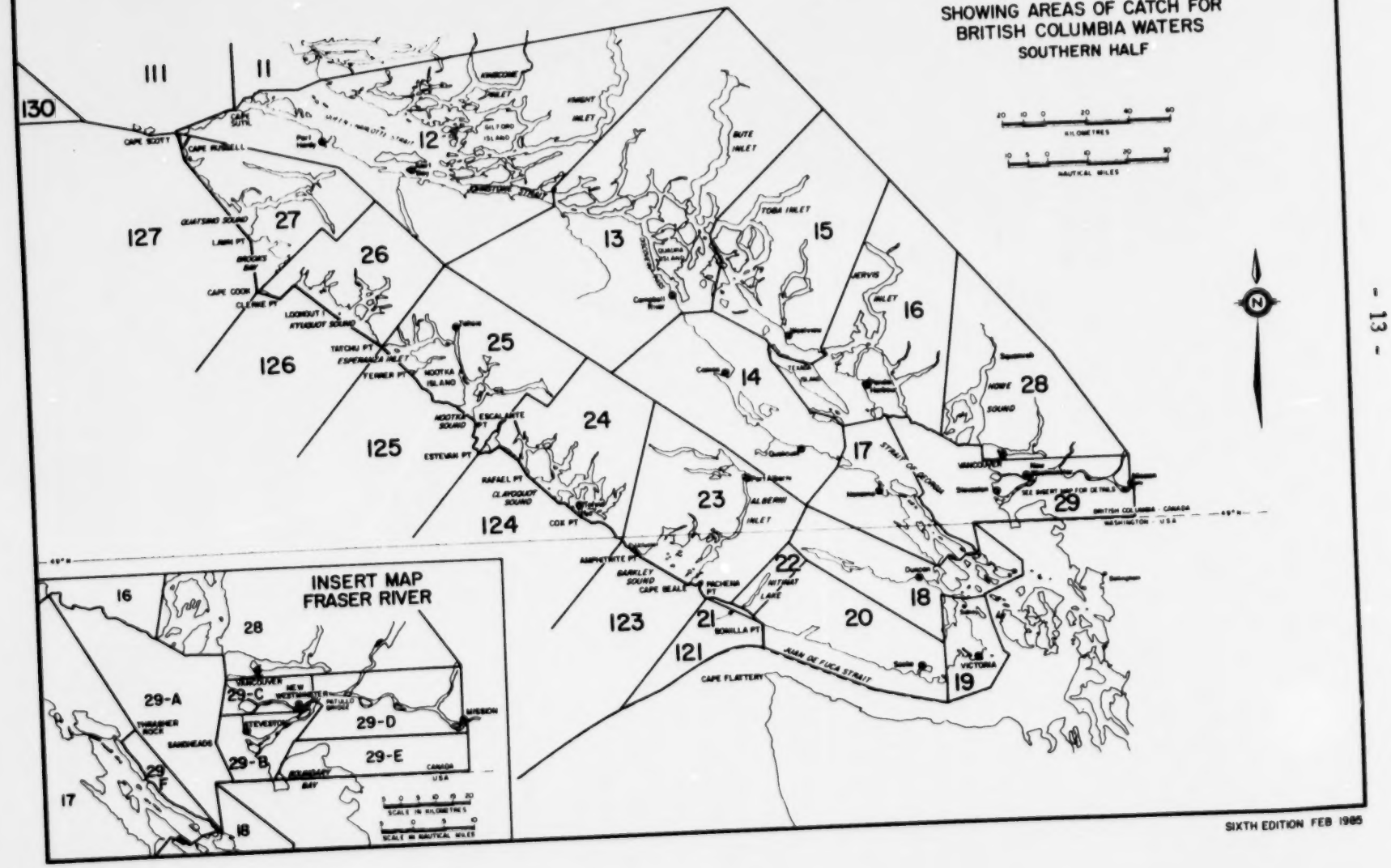


Fig. 1b. Statistical areas along the British Columbia north coast.

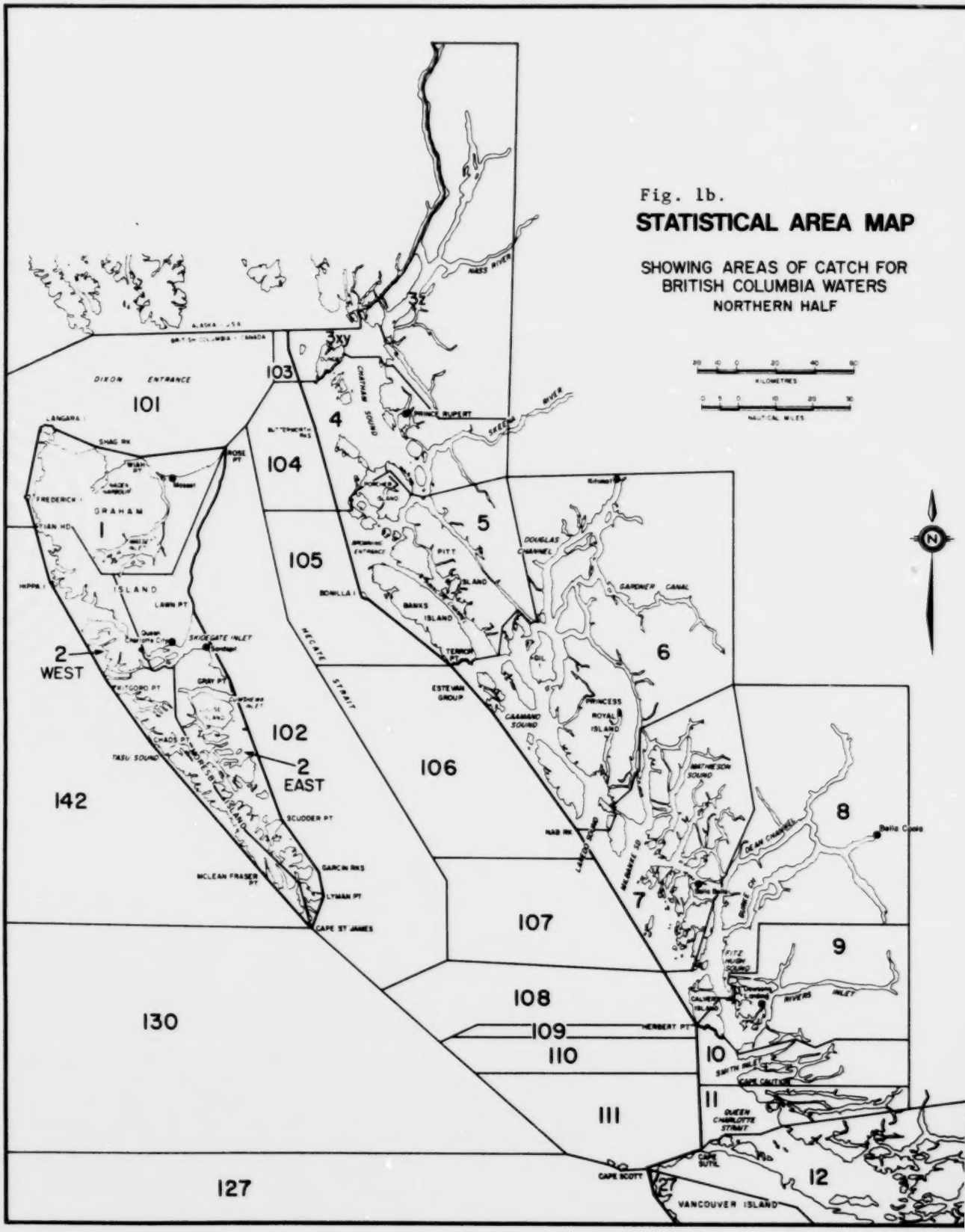


Fig. 1b.
STATISTICAL AREA MAP
SHOWING AREAS OF CATCH FOR
BRITISH COLUMBIA WATERS
NORTHERN HALF
KILOMETRES
NAUTICAL MILES
N
DIXON ENTRANCE
101
103
3xy
3z
4
104
105
5
6
2
WEST
2
EAST
102
106
142
107
108
130
109
110
111
127
7
8
9
10
11
12
GRAHAM
ISLAND
PITT
ISLAND
BANKS
ISLAND
VANCOUVER ISLAND
PRINCE RUPERT
SKIDEGATE INLET
SCUDDER PT
CAPE ST JAMES
CAPE SCOTT
HERBERT PT
CAPE BUTE
SMITH INLET
QUEEN CHARLOTTE STRAIT
DOUGLAS CHANNEL
GARDNER CANAL
PRINCESS ROYAL ISLAND
ESTEVAN GROUP
HECATE STRAIT
MASS RIVER
SKEENA RIVER
CHATHAM SOUND
DEAN CHANNEL
Bella Coola
FITZ HUGH SOUND
RIVERS INLET
LANGARA I.
SHAG RK
ROSE PT
FREDERICK I.
LAWN PT
SKIDEGATE INLET
GRAY PT
KITGORO PT
CHAOS PT
TASU SOUND
MCLEAN FRASER PT
SARCIN RKS
LYMAN PT
BONILLA I.
TERRACE PT
EGG I.
NAD INK
LAMEBEE SD
MATHIESON SOUND
CALVERT I.
DEVASTATION I.
LAGOON I.
BURKE

Fig. 2. Nearshore rockfish harvest log format.

SKIPPER _____ FISHING METHOD _____

VESSEL _____ CFV _____ CONFIDENTIAL

DATE (DAY-MO-YR)	STAT. AREA	LOCATION (NEAREST CHARTED LANDPOINT)	DEPTH (fm)	TIME SPENT FISHING * (HOURS)	NUMBER OF HOOKS	NUMBER OF FISH					REMARKS
						QUILL-BACK	COPPER	YELLOW-EYE (SNAPPER)	LING-COD	OTHER (SPECIFY)	

* ACTUAL TIME WITH FISHING GEAR IN THE WATER

MAIL TO: GROUNDFISH, PACIFIC BIOLOGICAL STATION, NANAIMO, B.C.

Fig. 3. Percentage of vessels complying with harvest log and sales slip regulations, 1986-1988. Number of vessels is given under each pie.

1986

Handline
N=583

Longline
N=362

1987

Handline
N=639

Longline
N=505

1988

Handline
N=588

Longline
N=506

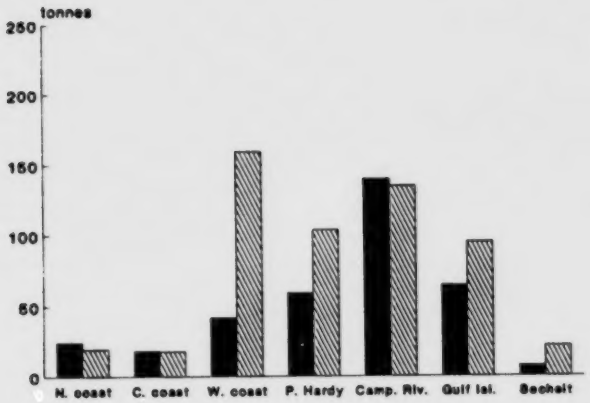
■ % submitting both logs and sales slips

▨ % submitting sales slips but not logs

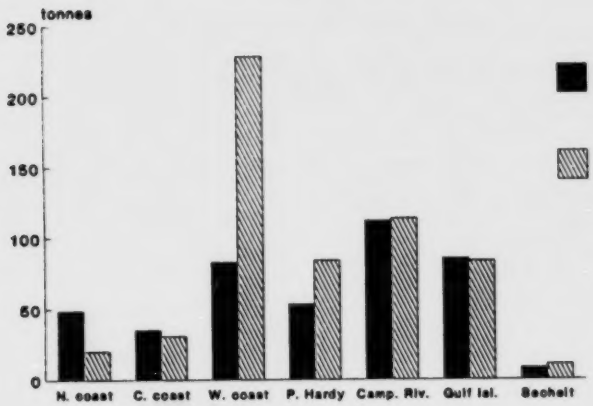
□ % submitting logs but not sales slips

Fig. 4a. Total rockfish handline/troll landings (t) by geographical area from harvest logs and sales slips, 1986-1988. Totals include yelloweye rockfish.

1986



1987



1988

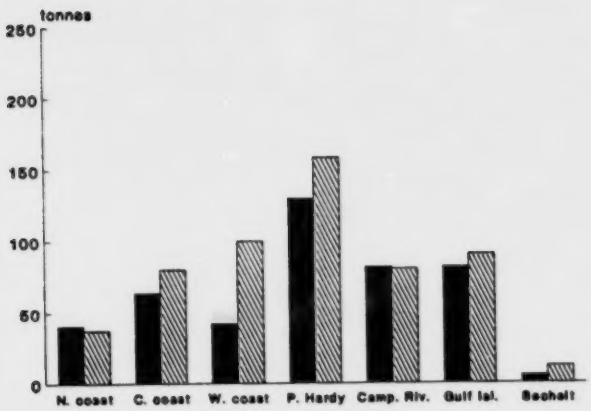
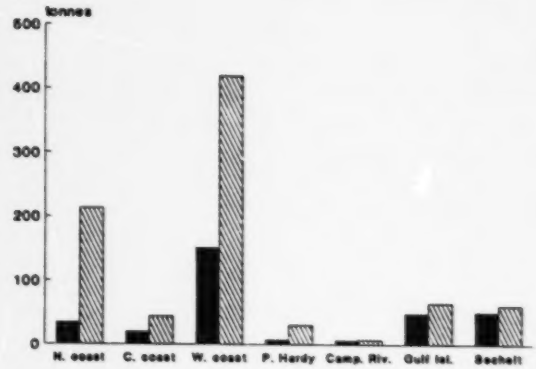
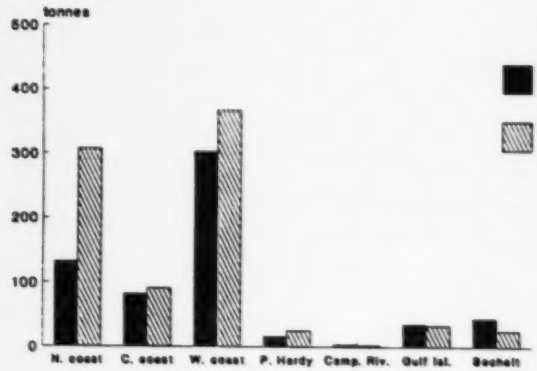


Fig. 4b. Total rockfish longline landings (t) by geographical area from harvest logs and sales slips, 1986-1988. Totals include yelloweye rockfish.

1986



1987



harvest log

sales slips

1988

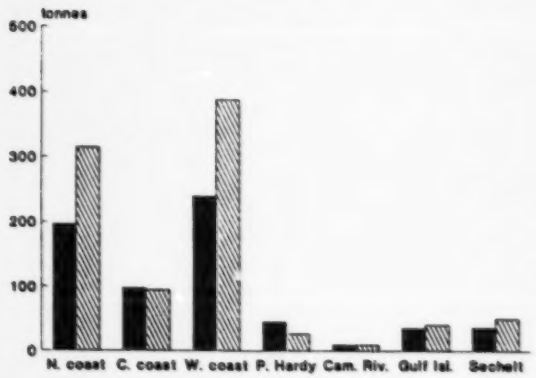
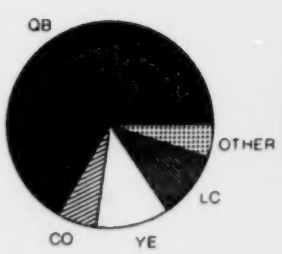
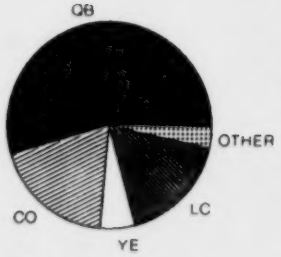


Fig. 5. Species composition of harvest log handline/troll catch by geographical area, 1986-1988. QB quillback rockfish, CO copper rockfish, YE yelloweye rockfish, OTHER unknown or other rockfish, LC lingcod.

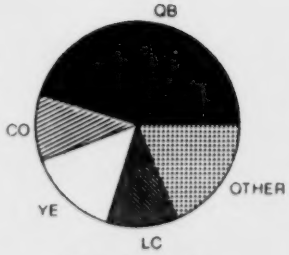
1986



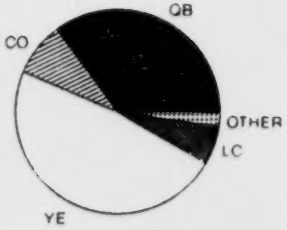
Port Hardy
12
66 t



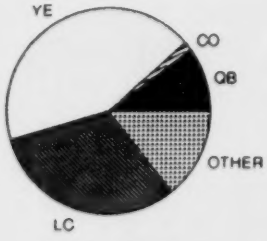
Campbell River
13
170 t



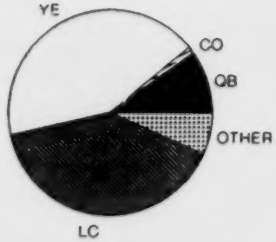
Gulf Islands
14,17-19
73 t



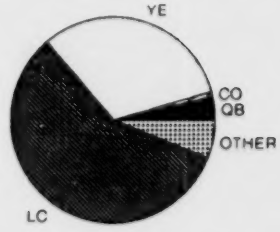
Sechelt
15,16
8 t



North Coast
1-5
36 t



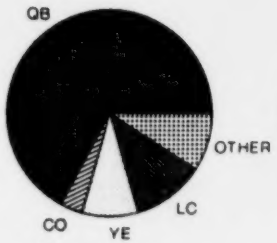
Central Coast
6-10
31 t



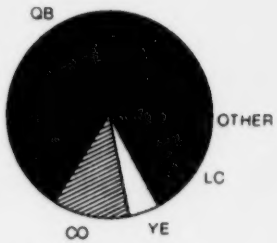
West Coast
11,20-27
105 t

Fig. 5 (cont'd)

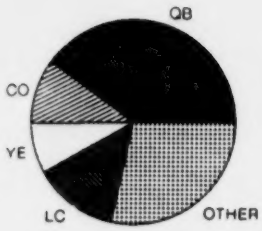
1987



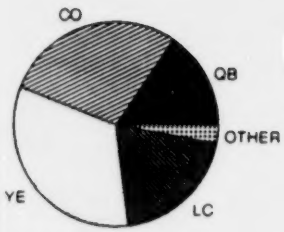
Port Hardy
12
60 t



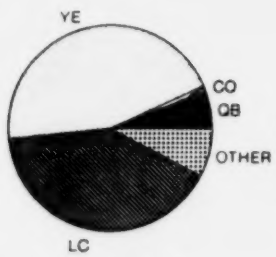
Campbell River
13
134 t



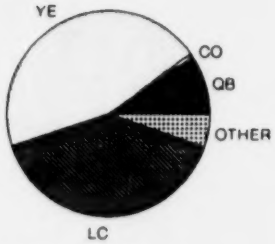
Gulf Islands
14,17-19
99 t



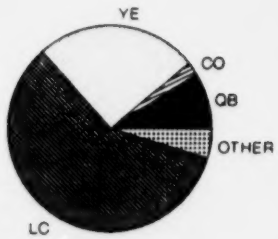
Sechelt
15,16
9 t



North Coast
1-5
82 t



Central Coast
6-10
59 t



West Coast
11,20,27
202 t

Fig. 5 (cont'd)

1988

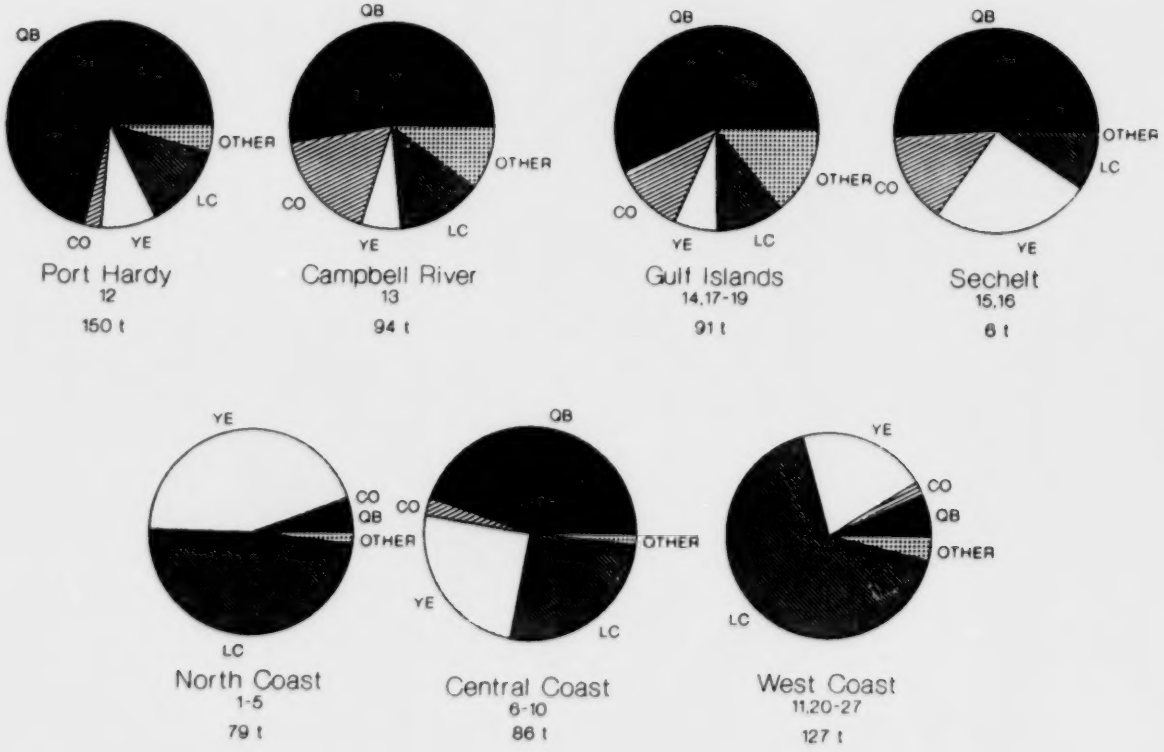

QB
OTHER
LC
CO
YE
Port Hardy
12
150 t
QB
OTHER
CO
LC
YE
Campbell River
13
94 t
QB
OTHER
CO
YE
LC
Gulf Islands
14,17-19
91 t
QB
OTHER
CO
LC
YE
Sechelt
15,16
6 t
YE
CO
QB
OTHER
LC
North Coast
1-5
79 t
QB
CO
OTHER
YE
LC
Central Coast
6-10
86 t
YE
CO
QB
OTHER
LC
West Coast
11,20-27
127 t

Fig. 6. Species composition of harvest log longline catch by geographical area, 1986-1988. QB quillback rockfish, CO copper rockfish, YE yelloweye rockfish, OTHER unknown or other rockfish, LC lingcod.

1986

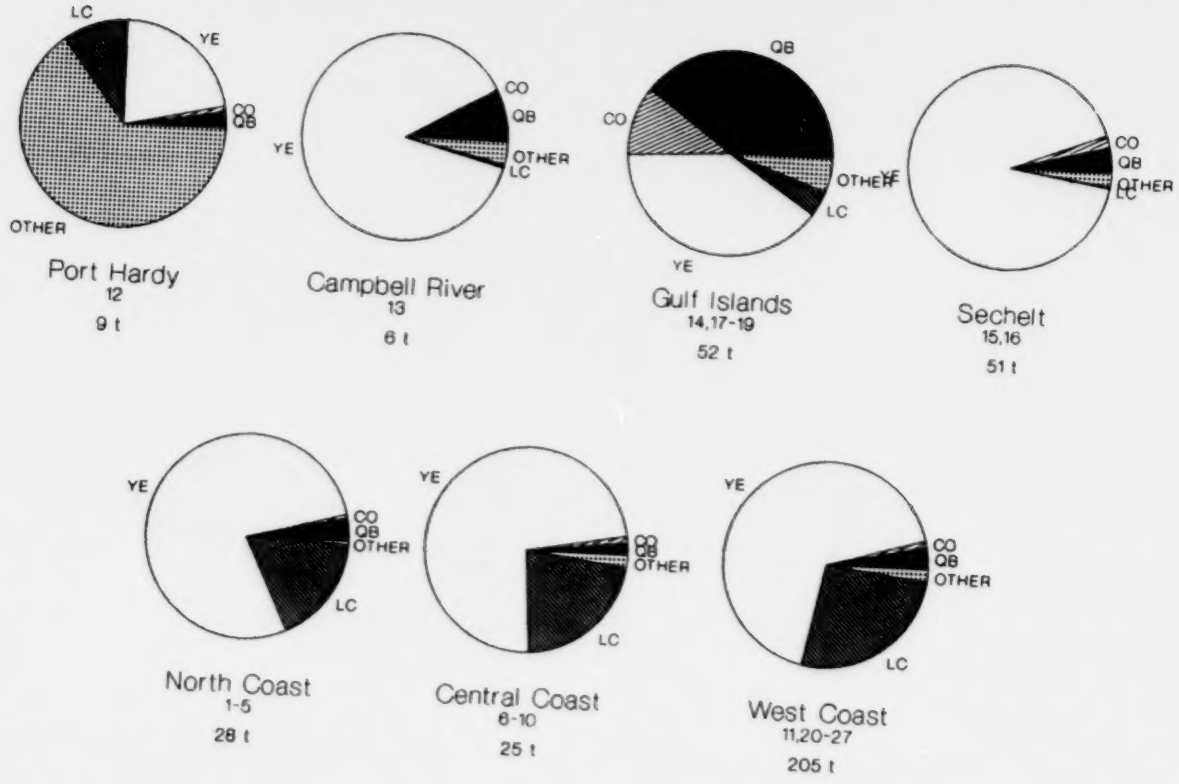

LC
YE
CO
QB
OTHER
Port Hardy
12
9 t
CO
QB
OTHER
LC
YE
Campbell River
13
6 t
QB
CO
OTHER
LC
YE
Gulf Islands
14,17-19
52 t
CO
QB
OTHER
LC
YE
Sechelt
15,16
51 t
YE
CO
QB
OTHER
LC
North Coast
1-5
28 t
YE
CO
QB
OTHER
LC
Central Coast
6-10
25 t
YE
CO
QB
OTHER
LC
West Coast
11,20-27
205 t

Fig. 6 (cont'd)

1987

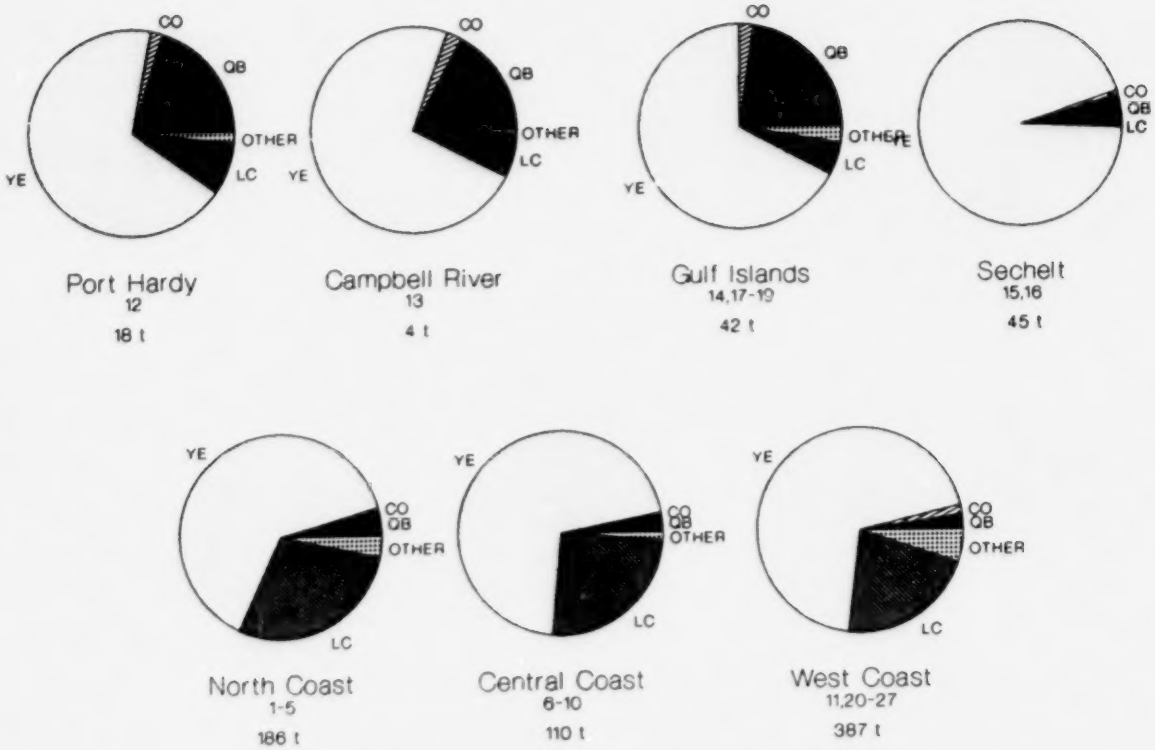
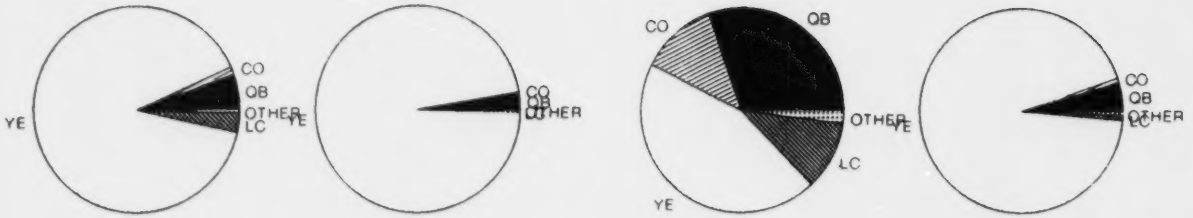

CO
QB
OTHER
LC
YE
Port Hardy
12
18 t
Campbell River
13
4 t
Gulf Islands
14,17-19
42 t
Sechelt
15,16
45 t
North Coast
1-5
186 t
Central Coast
6-10
110 t
West Coast
11,20-27
387 t

Fig. 6 (cont'd)

1988

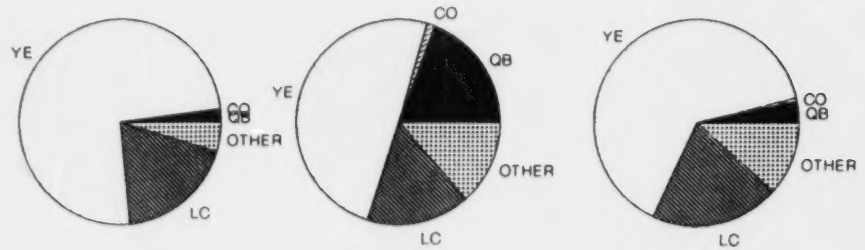


Port Hardy
12
47 t

Campbell River
13
9 t

Gulf Islands
14, 17-19
39 t

Sechelt
15,16
36 t

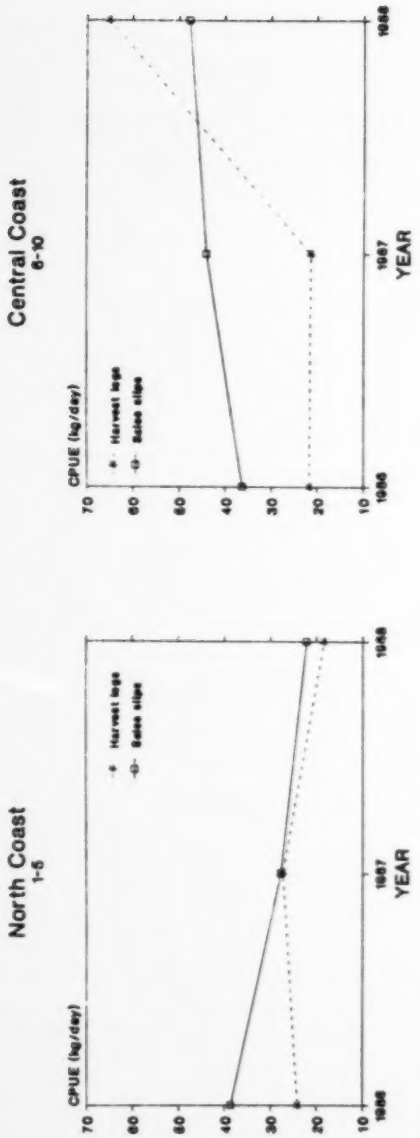


North Coast
1-5
241 t

Central Coast
6-10
116 t

West Coast
11, 20-27
301 t

Fig. 7. Rockfish handline/troll CPUE (kg/day) by geographical area and year from harvest logs and sales slips.


Central Coast
6-10
CPUE (kg/day)
Harvest logs
Sales slips
70
60
50
40
30
20
10
1986
1987
1988
YEAR

North Coast
1-5
CPUE (kg/day)
Harvest logs
Sales slips
70
60
50
40
30
20
10
1986
1987
1988
YEAR

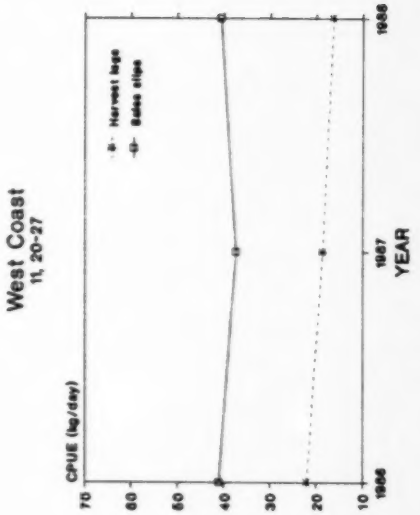
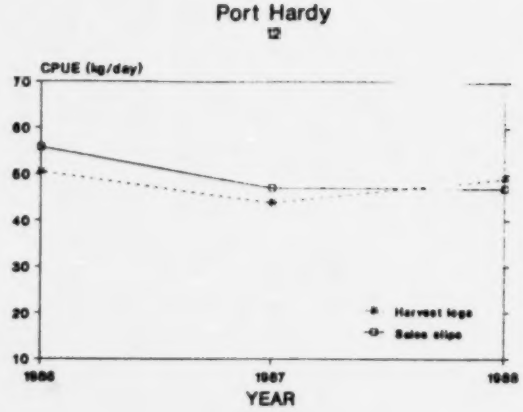
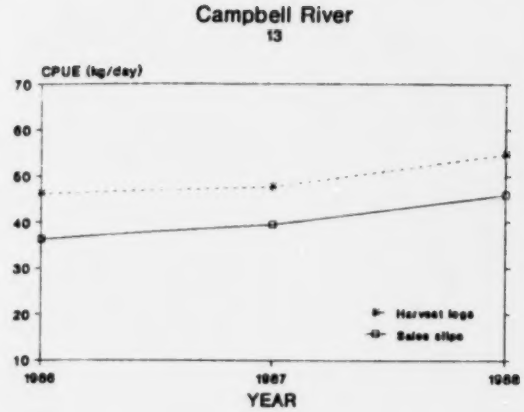
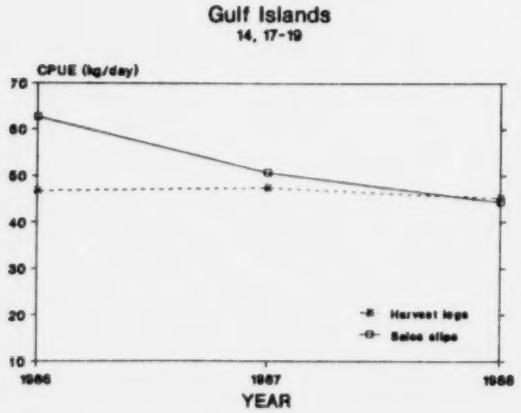

West Coast
11, 20-27
CPUE (kg/day)
Harvest logs
Sales slips
70
60
50
40
30
20
10
1986
1987
1988
YEAR

Fig. 7 (cont'd)


Port Hardy
12
CPUE (kg/day)
70
60
50
40
30
20
10
1986
1987
1988
YEAR
Harvest logs
Sales slips


Campbell River
13
CPUE (kg/day)
70
60
50
40
30
20
10
1986
1987
1988
YEAR
Harvest logs
Sales slips


Gulf Islands
14, 17-19
CPUE (kg/day)
70
60
50
40
30
20
10
1986
1987
1988
YEAR
Harvest logs
Sales slips

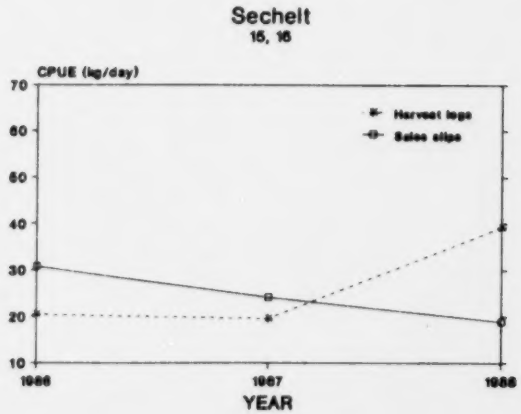
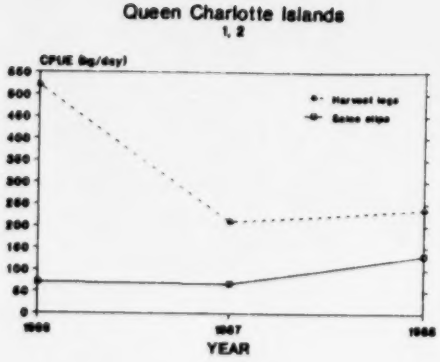
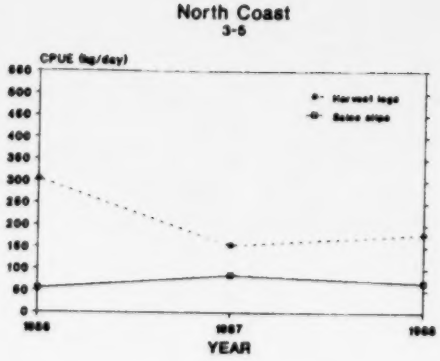
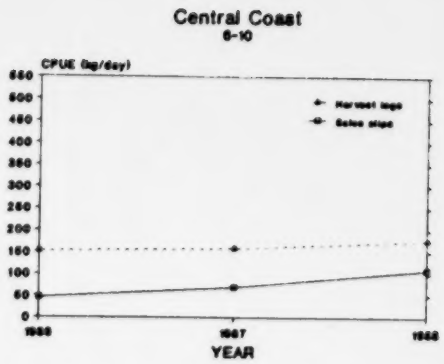
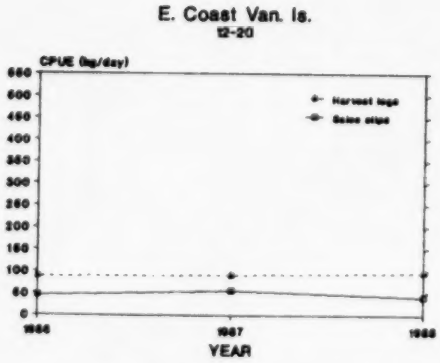

Sechelt
15, 16
CPUE (kg/day)
70
60
50
40
30
20
10
1986
1987
1988
YEAR
Harvest logs
Sales slips

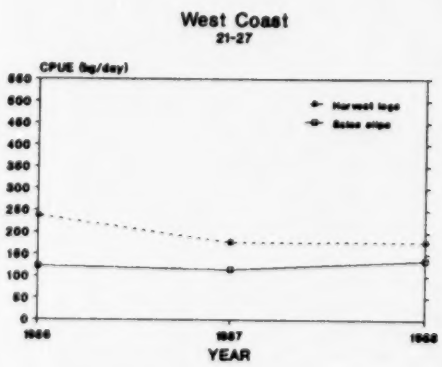
Fig. 8. Yelloweye longline CPUE (kg/day) by geographical area and year from harvest logs and sales slips.


Queen Charlotte Islands
1, 2
CPUE (kg/day)
YEAR


North Coast
3-5
CPUE (kg/day)
YEAR


Central Coast
6-10
CPUE (kg/day)
YEAR


E. Coast Van. Is.
12-20
CPUE (kg/day)
YEAR


West Coast
21-27
CPUE (kg/day)
YEAR